REMARKS

Status of Claims

- Claims **1-14, 17-30** and **35-44** are currently pending.
- All of the pending claims were rejected under 35 USC 103(a) in view of the following references.
- In this response, claim **28** is amended.

Amendments to the Claims

Applicants have amended claim **28** to include the limitation "*wherein the protective coating is insoluble in organic solvents*" to further define and distinguish the present invention.

Brief Summary of Cited References

- **Kao et al. (5,923,995)**

Kao et al. teach a device and method for protecting fabricated microelectromechanical (MEMS) systems located on a wafer during singulation of individual dies. The device includes a water-soluble first layer that covers the MEMS systems and a water-insoluble second layer covering the first protective layer. The water-insoluble second layer is needed to protect the water-soluble first layer from being dissolved by high-pressure water used as a coolant and lubricant during wafer saw cutting. After dicing the wafer into individual dies, the first protective layer is removed/dissolved using a water bath, which causes the second layer to simply detach from the first layer. Hence, both protective layers are removed in a single step using a simple water bath; thereby obviating the need for additional environmentally unfriendly solvents, such as acetone, which is a potential source of environmental pollution and harmful exposure of the workers to toxic chemicals.

- **Degani et al. (5,516,728)**

Degani et al. teach a method for protecting flip-chip mounted multichip modules (MCM's) from debris generated during wafer dicing. A protective coating is applied to the wafer prior to dicing, and then is removed after dicing. The coating is insoluble in water, but is soluble in polar organic solvents, such as methanol, ethanol, propanol, and isopropanol. The use of polar organic solvents in this invention (as opposed to non-polar organic solvents, e.g., acetone) is desirable because the adhesive used on adhesive tapes that hold the wafer/dices during the dicing process is not dissolved when the protective coating is removed.

- **Kaeriyama et al. (5,672,046)**

Kaeriyama et al. teach using a temporary protective layer to cover and protect sensitive areas (including MEMS devices) during partial wafer dicing and cleaning. The protective coating is subsequently removed before the wafer is broken along streets to form individual dies. *Kaeriyama* teaches that the protective coating is preferably a photoresist; and gives only one

example of a suitable coating, i.e., Microelectronics PFR1X710-D75 photoresist. Photoresists are soluble in organic solvents, i.e., acetone.

• Wu et al. "Interface-Adhesion-Enhanced Bi-layer Conformal Coating for Avionics Application"

Wu et al. teach a flexible, smooth, and low-profile conformal coating for encapsulating and protecting avionics MEMS devices (i.e., pressure sensors) and multichip modules (MCM's) from adverse environmental conditions, including jet fuel and oil. The protective coating has two layers: a thick (10 mil) first layer made of a low moisture permeable silicone elastomer, and a thin second layer (15-20 microns) made of Parylene C. In addtion, a special interlayer material is used to enable adhesion between the silicone elastomer and the Parylene C overcoat.

• Smith et al. (5,766,367)

Smith et al. teach a method of preventing micromechanical structures (MEMS) from adhering to themselves or other objects by exposing the released MEMS device to a solvent, e.g., hexamethyldisilazane, thereby forming an adhesion-inhibiting hydrophilic coating.

Rejection of Claims **1-14, 17-27** and **35-42** under 35 USC 103(a)

The office rejected claims **1-14, 17-27** and **35-42** under 35 USC 103(a) as being unpatentable over *Kao et al.* in view of *Wu et al.*

Applicants respectfully submit that the Office has failed to make a *prima facie* case of obviousness. In order to establish a *prima facie* case, there must be some suggest or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings in such a manner as to describe the claimed invention as a whole (see MPEP 2143).

The Office has failed to provide a convincing line of reasoning, specific understanding or principle within knowledge of a skilled artisan, or objective evidence that suggests or motivates the combination of *Kao et al.* and *Wu et al.* Without such support or rationale, the rejection of claims **1-14, 17-27** and **35-42** under 35 USC 103(a) is improper and should be withdrawn.

Specifically regarding claims **10-14, 17** and **19**, the Office states: "*Kao teaches that any conventional material can be used that is known to be capable of protecting underlying layers, which could include any of those materials listed in claims 10-14, 17 and 19.*" Applicants respectfully traverse. The only example of a water-insoluble protective layer taught by *Kao* is **photoresist**; no other examples are provided. There is no teaching, either explicitly or impliedly, that Kao's protective coating must be vapor-deposited, or must be insoluble in organic solvents, as required by the instant claims. The only example provided by *Kao* doesn't meet either of these two limitations, and there is no evidence that demonstrates *Kao* possessed knowledge any materials other than photoresist.

Additionally, the materials listed in claims **10-14, 17** and **19** do **provide unexpected results**, in view of *Kao et al.* Applicant's specification identified the problem with damage to fragile released MEMS structures from large hydrodynamic forces applied by liquids (e.g., when agitating in a bath, or when spin coating). *See* Specification p. 5, lines 9-11. The protective

coatings covered by claims **10-14, 17** and **19** are **vapor-deposited**, and, hence, **cannot apply large hydrodynamic forces**. *See* Specification p. 11, lines 22-24. Kao et al, on the other hand, do not discuss or appreciate the problems associated with damage to fragile released MEMS structures caused by application of liquid coatings (e.g., photoresist). Therefore, the **unexpected result** associated with applicant's vapor-deposited coatings is elimination of the potential for damage to fragile released MEMS structures from large hydrodynamic forces applied by application of a liquid.

Another **unexpected benefit** of applicant's coatings relates to the way that the protective coating is removed. In *Kao et. al.*, the protective coating is removed by "immersing, spraying, or dipping the wafer in water" See *Kao et al.* Col. 5, lines 64-68. However, *Kao's* method exposes the fragile released MEMS structures to large hydrodynamic forces, which may damage them. On the other hand, applicant's water-insoluble and organic-insoluble protective coating cannot be removed by liquid water or liquid organic solvents; rather, they are removed by a dry etching process, such as plasma etching or exposure to reactive gases. *See* Specification, p. 13, lines 15-23. The dry etching process does not expose the fragile released MEMS structures to large hydrodynamic forces. Hence, applicant's coatings have the **unexpected benefit** of eliminating the potential for damage to fragile released MEMS structures from large hydrodynamic forces applied by liquids/solvents used to remove the coating.

Additionally, applicants respectfully **traverse** the Office's assertion that the materials recited in claims **12-14** and **17-19** are conventional materials for protecting microelectronic devices. Conventional protective coatings (other than parylene) well known in the art of microelectronics packaging include epoxies, glob-top polymers, polyimides, silicones, elastomers, plastic, resins, and injection/transfer molded plastic. Conversely, the protective coatings recited in claims **12-14** and **17-19**, e.g., carbon films, diamond films, metals such as aluminum or tungsten, self-assembled monolayered materials, perfluoropolyether, silicon dioxide, silicate glass, and silicon nitride are **unconventional** materials. Applicants respectfully request that the Office provides specific evidence supporting their assertion that these are conventional materials.

In summary, *Kao et al.* does not teach or suggest the specific materials recited in claims **10-14, 17** and **19**. Also, applicant's materials provide two different types of unexpected (beneficial) results that distinguish the present invention over *Kao et al.* Finally, applicant's materials are not conventional materials. Accordingly, the rejection of claims **10-14, 17** and **19** as being obvious in view of *Kao et al.* is improper and should be withdrawn.

Rejection of Claims **1, 7-14, 17-19, 21-27** and **35-42** under 35 USC 103(a)

The office rejected claims **1, 7-14, 17-19, 21-27** and **35-42** under 35 USC 103(a) as being unpatentable over *Kao et al.* in view of *Degani et al.*

Applicants respectfully submit that the Office has failed to make a *prima facie* case of obviousness. In order to establish a *prima facie* case, there must be some suggest or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings in such a manner as to describe the claimed invention as a whole (see MPEP 2143).

The Office has failed to provide a convincing line of reasoning, specific understanding or principle within knowledge of a skilled artisan, or objective evidence that suggests or motivates

the combination of *Kao et al.* and *Degani et al.* Without such support or rationale, the rejection of claims **1, 7-14, 17-19, 21-27** and **35-42** under 35 USC 103(a) is improper and should be withdrawn.

Rejection of Claims **1-14, 17-19, 21-27** and **35-42** under 35 USC 103(a)

The office rejected claims **1-14, 17-19, 21-27** and **35-42** under 35 USC 103(a) as being unpatentable over *Kao et al.* in view of *Kaeriyama et al.*

Applicants respectfully submit that the Office has failed to make a *prima facie* case of obviousness. In order to establish a *prima facie* case of obviousness, there must be some suggest or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings in such a manner as to describe the claimed invention as a whole (see MPEP 2143).

The Office has failed to provide a convincing line of reasoning, specific understanding or principle within knowledge of a skilled artisan, or objective evidence that suggests or motivates the combination of *Kao et al.* and *Kaeriyama et al.* Without such support or rationale, the rejection of claims **1-14, 17-19, 21-27** and **35-42** under 35 USC 103(a) is improper and should be withdrawn.

Accordingly, claims **1-14, 17-27** and **35-42** are now in condition for allowance.

Rejection of Claims **28-30** and **43-44** under 35 USC 103(a)

The office rejected claims **28-30** and **43-44** under 35 USC 103(a) as being unpatentable over *Kao et al.* in view of *Smith et al.*

In response, applicants have amended claim **28** to recite, *inter alia*, a limitation that the **protective coating is insoluble in organic solvents.** Claim **43** includes the same limitation.

As admitted by the Office, *Kao et al.* does not teach the protective coating as being insoluble in organic solvents. Since *Kao et al.* does not teach all of the limitations of claims **28** and **43**, a *prima facie* case of obviousness cannot be made, and, hence, the rejections should be withdrawn. Accordingly, claims **28** and **43** are now in condition for allowance.

Claims **29-30** depend from claim **28**. As presented above, claim **28** is now in condition for allowance. All claims depending from an allowed claim are allowable. Therefore, claims **29-30** are now in condition for allowance.

Claim **44** depends from claim **43**. As presented above, claim **43** is now in condition for allowance. All claims depending from an allowed claim are allowable. Therefore, claim **44** is now in condition for allowance.

CONCLUSION

Applicants have responded to each and every objection and rejection, and urge that claims **1-14, 17-30** and **35-44** as presented are now in condition for allowance. Applicants request expeditious processing to issuance.

The Office is hereby authorized to charge **$110** (large entity fee) for an Extension for Response Within First Month under 37 CFR 1.17(a)(1) to **Deposit Account # 19-0131.**

Respectfully submitted,

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